REMARKS

In view of the above amendments and the following remarks, reconsideration of the rejections and objections, and further examination are requested.

Claims 1-16 are pending in this application and stand rejected. Claims 1-4, 6-12 and 14-16 are amended herein. No new matter has been added.

The Examiner objected to the specification on the basis that in line 5, on page 21, --invention-- should be inserted after "present."

The specification and abstract have been carefully reviewed and revised to make grammatical and idiomatic improvements in order to aid the Examiner in further consideration of the application, and to address the Examiner's concerns. A substitute specification and abstract including the revisions have been prepared and are submitted herewith. No new matter has been added. Also submitted herewith are marked-up copies of the substitute specification and abstract indicating the changes incorporated therein.

The Examiner objected to claims 1, 4, 6, 7, 10, 12, 14 and 15 on the basis that they included minor informalities. The Examiner's objections to these claims have been addressed.

Claims 1-16 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention. Claims 1-4, 6-12 and 14-16 have been amended to address the Examiner's concerns.

Claims 1-16 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Saeki (U.S. Patent Application Publication No. 2003/0006279) (hereinafter referred to as "Saeki") in view of Asami (U.S. Patent No. 6,036,100) (hereinafter referred to as "Asami").

Independent claims 1, 6, 9 and 14 have been amended to distinguish over the references cited by the Examiner. The above rejections are submitted to be inapplicable to the amended claims for the following reasons.

Claim 1 recites an electric apparatus including, in part, an interface section that includes error information about an inability of accepting data blocks of a specified block size in a response corresponding to a command different from a block size setting command and transmits the response including the error information to a host device, when the specified block size is larger than a capacity of a data buffer.

As admitted by the Examiner in the Office Action, Saeki does not disclose "transmitting error information when an error is detected." The Examiner cited Asami as teaching this feature, and specifically asserted that Asami discloses "error detection processing to check for errors and transmit error message."

In contrast to the present invention, Asami does not disclose transmitting a response including error information to a host device when a specified block size is larger than a capacity of a data buffer. Instead, Asami discloses a control circuit 8 that executes a particular error process for received data. Specifically, as control circuit 8 receives data, an error detection process such as a checksum operation, is executed on the received data to check for data errors. Moreover, there is no disclosure or suggestion to modify Asami to transmit a response including error information based on a specified block size of data.

In other words, Asami does not disclose including *error information about an inability of accepting data blocks of a specified block size in a response corresponding to a command different from a block size setting command, and transmitting the response including error information to a host device when the specified block size is larger than a capacity of a data buffer.*

For at least the reasons discussed above, it is believed clear that Asami fails to disclose or suggest the present invention as recited in claim 1.

Regarding claim 9, it is patentable over the references relied upon in the rejections for reasons similar to those set forth above in support of claim 1. That is, claim 9 similarly recites *including error information about an inability of accepting data blocks of a block size in a response corresponding to a different command from a block size setting command, and transmitting the response including error information to a host device, when the block size included in received information is larger than a capacity of a built-in data buffer.*

Regarding claims 6 and 14, they are patentable over the references relied upon in the rejections for reasons similar to those set forth above in support of claim 1. That is, claims 6 and 14 similarly recite that *when an interface section transmits a command different from a block size setting command and receives a response to the different command, and when the response includes error information about an inability of accepting a block size of the data block, the interface section transmits an inquiry about a data capacity of a data buffer to an electronic apparatus through a command/response line, determines a new block size which is not more*

than the capacity of the data buffer in the electronic apparatus based on a response corresponding to the inquiry, and sets the new block size to the electronic apparatus.

For at least the reasons set forth above, it is respectfully submitted that the above-discussed features as recited in claims 1, 6, 9 and 14 are not disclosed in the references applied by the Examiner. Furthermore, it is respectfully submitted that one of ordinary skill in the art at the time the invention was made would not have modified Saeki in such a manner as to result in, or otherwise render obvious, the invention of claims 1, 6, 9 and 14. Therefore, it is respectfully submitted that claim 1 and claims 2-5 depending therefrom, claim 6 and claims 7 and 8 depending therefrom, claim 9 and claims 10-13 depending therefrom, and claim 14 and claims 15 and 16 depending therefrom are clearly allowable.

In view of the foregoing amendments and remarks, all of the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action are respectfully solicited.

Should the Examiner believe there are any remaining issues that must be resolved before this application can be passed to issue, it is respectfully requested that the Examiner contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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DESCRIPTION

ELECTRONIC APPARATUS, CONTROL METHOD THEREOF, HOST DEVICE, AND CONTROL METHOD THEREOF

~~Technical Field~~BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electronic apparatus, a control method thereof, a host device, and a control method thereof.

~~Background Art~~2. Description of the Related Art

In recent years, IC (Integrated Circuit) cards (included in an electronic apparatus) having a non-volatile memory and another function ~~are~~ have been developed and spread on the market. For example, a technique such that an IC card having a flash memory and a wireless communication function is attached to PDA (Personal Digital Assistants: host device), the IC card receives video data and audio data and ~~transmitted~~ transmits them to the PDA, and the PDA outputs the video data and the audio data from a display and a speaker thereof is being realized.

Conventionally, a function that a host device such as PDA transmits data to an IC card and the data are stored in a flash memory of the IC card is put to practical use.

In general, data transmission between a host device

and an IC card is executed by means of a master/slave communication system in which the host device is a master. The host device transmits a command to the IC card, and accordingly the IC card returns a response to the host device. There are a host device and an IC card which can further transmit data as required after transmitting and receiving the command and the response respectively. The host device determines timing of the data transmission and a size of data, and accordingly the IC card receives or transmits the data.

One of the data transmissions between a host device and an IC card is a method called a multi-block transmission. The multi-block transmission is a method of, when data is a predetermined length or more (typically, a length of not less than a predetermined block size), (1) dividing the data into a plurality of data blocks with the predetermined block size and (2) intermittently transmitting the data blocks.

The host device determines a block size of one data block and transmits information about the block size to the IC card before transmitting the data. Concretely, the host device transmits a command (called as “the first block size setting command”) including block size setting data of 1 byte to the IC card, and the IC card sets received block setting size data in a register of the IC card.

Generally, the host device reads a capacity of a data buffer for transmission and reception in the IC card from the IC card, and sets the block size to a size not more than the capacity.

However, general-purpose IC cards can be attached to various host devices. The host devices can be mounted with various IC cards (all the IC cards conform to the same standard). For this reason, some host devices occasionally may not read a capacity of a data buffer in an IC card or improperly read it and set a block size which is larger than the capacity of the data buffer in the IC card.

In case that a data block having larger size than the capacity of the data buffer is transmitted from the host device to the IC card, the data buffer of the IC card overflows. Further, in case that the host device requests the IC card to transmit the data block having larger size than the capacity of the data buffer, the IC card can not transmit the data block. For this reason, when the IC card receives the command of setting the block size larger than the capacity of the data buffer, the IC card should transmit error information to the host device.

When the host device receives the error information as a response to the command of setting the block size, it should newly transmit a command of setting a block size not more than the capacity of the data buffer.

The IC card receives the first block size setting command including the block size setting data. When the block size setting data are larger than a buffer capacity, the IC card transmits the response which corresponds to the first block size setting command and includes error information to the host device. As a result, the data buffer of the IC card is prevented from overflowing at the time of the transmission/reception of the block size in advance.

The case of transmitting data from the host device to the IC card (transmitting a data writing command from the host device to the IC card) is explained. Firstly, the host device divides data to be transmitted according to a predetermined block size so as to create a plurality of data blocks. Then, the host device sequentially transmits the plural data blocks to the IC card.

The case of transmitting data from the IC card to the host device (transmitting a data reading command from the host device to the IC card) is explained. Firstly, the IC card divides data to be transmitted according to a block size set by the host device so as to create a plurality of data blocks. Then, the IC card sequentially transmits the plural data blocks to the host device.

Since the plural data blocks are intermittently transmitted, the multi-block transmission is effective for

transmitting a large amount of data at a high speed.

Japanese Patent Application Laid-Open No. 11-298450 discloses an IC card of a conventional example that transmits an error signal to a host device when an overflow occurs at the time of serial data transmission. The conventional IC card transmits the error signal to the host device without via a built-in CPU. The conventional IC card transmits error information to the host device when a built-in receiving data buffer overflows.

Patent Document 1: Japanese Patent Application Laid-Open No. 11-298450

DISCLOSURE OF THE INVENTION

Problems to be Solved by the Invention

Conventionally, the block size in the multi-block transmission is set only by means of the first block size setting command including the block size setting data. The block size setting data which can be included in the first block size setting command ~~are~~ is determined to be 1 byte, for example, according to a protocol.

When the memory capacity of an IC card increases and a large amount of data ~~are~~ is transmitted between the IC card and a host device, 1 byte is insufficient ~~to~~ for the block size setting data. The host device, however, can not transmit data with block size of 2 bytes to the IC card by

using the first block size setting command having a data area of only 1 byte.

Therefore, use of a command (called as "second block size setting command") such that the host device can transmit data with block size of not less than 2 bytes to the IC card is proposed in addition to using the conventional first block size setting command.

The second block size setting command does not include block size setting data therein. The second block size setting command is transmitted based on protocols such that (1) the host device transmits a command ~~of~~ indicating that the block size setting data is transmitted, (2) the host device receives a response from the IC card, and (3) thereafter, the host device transmits the block size setting data.

The host device and the IC card exchange the command, the response and the data in this order. For this reason, when the block size setting data is larger than the capacity of the data buffer, the IC card can not transmit the response including the error information about the too large setting data.

When the second block size setting command is used and the block size setting data are larger than the capacity of the data buffer, the IC card can not transmit the error information as the response to the host device.

If both the first block size setting command and the second block size setting command are enabled to be used in order to set the block size, the error information about the setting of the block size is returned from the IC card to the host device in some occasions and is not returned in the other occasions according to commands to be used. For this reason, a design of the host device becomes complicated.

The data transmission timing is, therefore, set before the response, and thus it is considered that the command, the data and the response are exchanged in this order. If the host device transmits the block size setting command to the IC card according to the protocols, the IC card receives the block size setting data before returning the response. For this reason, when the block size is too large, the IC card can return the error information as the response.

In the data transmission according to the protocols, however, in case that an error is present in a command (for example, the command is for transmitting data which cannot be treated by the IC card from the host device), the IC card cannot immediately return the error information as the response. For this reason, much data are transmitted wastefully.

The conventional IC card described in the patent

document 1 receives data and when the received data buffer overflows, it transmits an error signal to the host device. For this reason, the transmission of the data from the host device is useless. The host device must transmit the data which cannot be received by the IC card again. If the IC card can transmit error information such that the overflow occurs to the host device before the host device transmits the data, the problem that wasteful data are transmitted (the data which cannot be received by the IC card are transmitted) can be prevented in advance.

The present invention is devised to solve the above conventional problems and its object is to provide an electronic apparatus that, when a host device transmits block size setting data according to a protocol such that a command, a response and data ~~is~~ are transmitted in this order between the host device and an electronic apparatus (for example, IC card), and the electronic apparatus cannot accept the block size setting data, the electronic apparatus transmits error information to the host device, a control method thereof, a corresponding host device and a control method thereof.

It is an object of the present invention to provide an electronic apparatus that transmits error information about setting of block size to a host device at predetermined timing regardless of a type of a block size setting command,

a control method thereof, a corresponding host device and a control method thereof.

It is an object of the present invention to provide an electronic apparatus that transmits error information about setting of block size to a host device without making a design of the host device complicated, a control method thereof, a host device and a control method thereof.

It is an object of the present invention to provide an electronic apparatus that prevents an overflow of a data buffer for transmission/reception of the electronic apparatus in advance, a control method thereof, a host device and a control method thereof.

It is an object of the present invention to provide an electronic apparatus wherein a general-purpose host device and a general-purpose electronic apparatus can be combined with compatibly, a control method thereof, a host device and a control method thereof.

Means for Solving the Problems

In order to achieve the above objects, the present invention has the following constitution.

An electronic apparatus in accordance with one aspect of the present invention includes: an interface section that is connected to a command/response line for receiving a command from a host device and transmitting a response to

the host device and a data line for transmitting and receiving data according to the command as required after transmitting and receiving the command and the response to and from the host device via the command/response line~~, the~~. The data ~~being~~ is transmitted or received while the data is divided into data blocks with a block size specified by the host device when the data length is a predetermined length or ~~more;~~more. Moreover, the electronic apparatus includes a data buffer that stores the ~~data;~~data and a storage section that stores information about the block size when the interface section receives a command for specifying the block size of the data block from the host device~~; wherein when~~. When the interface section receives a command (hereinafter, “block size setting command”) for transmitting data including information about the block size of the data block via the data line from the host device, and when the block size is lager than a capacity of the data buffer, the interface section transmits a response including error information about incapability of accepting the block size at a time which has a predetermined relation to the block size setting command.

A control method of an electronic apparatus in accordance with one aspect of the present invention includes the steps of: receiving a block size setting command transmitted from a host device via a

command/response line, where the block size setting command ~~being~~ is a request for transmitting data including information about a block size of the data block via a data line when data with a predetermined length or more are divided into a plurality of data blocks and the data blocks are transmitted or received~~,~~. Moreover the method includes transmitting a response corresponding to the block size setting command via the command/response ~~line,~~line and receiving the ~~data;~~data, determining whether the block size is larger than a capacity of a built-in data ~~buffer;~~buffer, and transmitting a response including error information about incapability of accepting the block size at the time which has a predetermined relation to the block size setting command.

The block size setting command is a "second block size setting command" in an embodiment.

These inventions can realize the electronic apparatus and the control method thereof, wherein, in a case that the host device transmits the block size setting data according to a protocol such that the host device and the electronic apparatus (for example, IC card) transmit a command, a response and data in this order, when the electronic apparatus cannot accept the block size setting data, the electronic apparatus transmits error information to the host device.

These inventions realize the electronic apparatus that transmits the error information about the setting of the block size at predetermined timing to the host device without making a design of the host device complicated and the control method thereof.

In the electronic apparatus in accordance with another aspect of the present invention, the time which has a predetermined relation is the time when the electronic apparatus receives a command for actually transmitting or receiving the data blocks with the block size created by dividing the data with the predetermined length or more from the host device~~, and the~~. The electronic apparatus transmits the response to the command with the error information included in the response, and does not accept the data blocks when receiving the divided data blocks from the host device.

In the control method of the electronic apparatus, the time which has a predetermined relation is the time when the electronic apparatus receives a command for actually transmitting or receiving the data blocks with the block size created by dividing the data with the predetermined length or more from the host device~~, and the~~. The electronic apparatus transmits the response to the command with the error information included in the response and does not accept the data blocks when receiving the divided

data blocks from the host devices.

According to these inventions, the host device receives the response to “the command for actually transmitting or receiving the data blocks”, and can check the error information about the setting of the block size. As a result, the host device can receive the error information from the electronic apparatus without making the design of the host device complicated.

In the electronic apparatus in accordance with another aspect of the present invention, the time which has a predetermined relation is the time when the electronic apparatus receives a command next to the block size setting command transmitted from the host device~~, the~~. The electronic apparatus adds the response including the error information to the response corresponding to the next command, and then transmits the response.

In the control method of the electronic apparatus in accordance with another aspect of the present invention, the time which has the predetermined relation is the time when the electronic apparatus receives a command next to the block size setting command transmitted from the host device, and the electronic apparatus adds a response including the error information to the response corresponding to the next command, and then transmits the response.

According to these inventions, the host device receives the response to a command next to the block size setting command, and can check the error information about the setting of the block size. As a result, the host device can receive the error information from the electronic apparatus without making the design of the host device complicated.

In the electronic apparatus in accordance with still another aspect of the present invention, in a case that the interface section receives a command including information about the block size of the data block from the host device via the command/response line and the block size is larger than the capacity of the data buffer, when the electronic apparatus receives a command for actually transmitting or receiving the data blocks with the block size created by dividing the data with the predetermined length or more from the host device, the electronic apparatus transmits a response corresponding to the command and including error information about incapability of accepting the block ~~size,~~size. When ~~and when~~ the divided data blocks are transmitted from the host device, the electronic apparatus does not accept the data blocks, or the electronic apparatus adds information about the error response corresponding to the command for specifying the block size to a response corresponding to a next command transmitted

from the host device, and then transmits the response.

In the control method of the electronic apparatus in accordance with still another aspect of the present invention, further has a step of receiving a command including information about the block size of the data block from the host device via the command/response ~~line, wherein in~~line. In a case that the determination is made that the block size is larger than the capacity of the data buffer at the determining step, when the electronic apparatus receives a command for actually transmitting or receiving the data blocks with the block size created by dividing the data with the predetermined length or more from the host device, the electronic apparatus transmits a response corresponding to the command and including error information about incapability of accepting the block~~ size, and when~~. When the divided data blocks are transmitted from the host device, the electronic apparatus does not accept the data blocks, or the electronic apparatus adds information about the error response corresponding to the command for specifying the block size to the response corresponding to the next command transmitted from the host device, and then transmits the response.

“The command including information about the block size of the data block” which is received by the electronic apparatus via the command/response line is “a first block

size setting command” in an embodiment.

According to these inventions, similarly to a second block size setting command, a response to a predetermined command after a first block size setting command includes response to the first block size setting command. The host device can receive error information about the block size at constant timing regardless of types of block size setting commands to be transmitted.

These inventions realize the electronic apparatus that transmits the error information about the setting of the block size to the host device without making the design of the host device complicated and the control method thereof.

The electronic apparatus ~~in~~ according ~~with~~ to still another aspect of the present invention is an IC card.

In the control method of the electronic apparatus ~~in~~ according ~~with~~ to still another aspect of the present invention, the electronic apparatus is an IC card.

These ~~invention~~ inventions are effective in the general-purpose ICs card having various product variations.

A host device in accordance with one aspect of the present invention includes: an interface section that is connected to a command/response line for transmitting a command to an electronic apparatus and receiving a response from the electronic apparatus, and a data line for transmitting and receiving data according to the command as

required after transmitting and receiving the command and the response to and from the electronic apparatus via the command/response line~~, when~~. When the data is a predetermined length or more, the interface section ~~transmitting~~ transmits and ~~receiving~~ receives data blocks with a predetermined block size created by dividing the data, and ~~transmitting~~ transmits a command for specifying the block size to the electronic apparatus~~, wherein the~~. The interface section transmits a block size setting command for transmitting data including information about the block size of the data blocks via the data line to the electronic apparatus, after the data are transmitted, at the time which has a predetermined relation to the block size setting command, when receiving a response including error information about incapability of accepting a specified value of the block size of the data from the electronic apparatus~~, the~~. The interface section transmits a command for inquiring about a data capacity of a data buffer to the electronic apparatus, determines a new block size which is not more than the capacity of the data buffer in the electronic apparatus based on the response, and transmits a command for specifying the new block size to the electronic apparatus.

A control method of a host device in accordance with one aspect of the present invention includes the steps of:

transmitting a block size setting command via a command/response line to an electronic apparatus, the block size setting command being a request for transmitting data including information about a block size of the data block via a data line when the data with a predetermined length or more are divided into a plurality of data blocks and transmitted or received, receiving a response corresponding to the block size setting command via the command/response line, and transmitting the ~~data;~~data. Moreover, the method includes transmitting a command for inquiring about a data capacity of a data buffer to the electronic apparatus when a response including error information about incapability of accepting the block size is received at the time which has a predetermined relation to the block size setting ~~command;~~command, and determining a new block size which is not more than the capacity of the data buffer in the electronic apparatus based on a response corresponding to the inquiring command and transmitting a command for specifying the new block size to the electronic apparatus.

These inventions have effects which can realize the host device having a simple structure and the control method thereof which ~~have~~ function such that: (1) the host device connected to the electronic apparatus (for example, IC card) transmits the block size setting data; and (2) when the electronic apparatus transmits the error

information such that it cannot accept the block size setting data, the host device changes the block size setting data suitably so that multi-block transmission is executed.

In the host device in accordance with another aspect of the present invention, the time which has the predetermined relation is the time when the host device transmits a command for actually transmitting or receiving the data created by dividing the data with the predetermined length or more according to the block size to the electronic apparatus.

In the control method of the host device in accordance with another aspect of the present invention, the time which has the predetermined relation is the time when the host device transmits a command for actually transmitting or receiving the data created by dividing the data with the predetermined length or more according to the block size to the electronic apparatus.

According to these inventions, the host device receives a response to a command for actually transmitting or receiving the data created by dividing the data with the predetermined length or more according to the block size, and can check the error information about the setting of the block size. As a result, the host device can receive the error information from the electronic apparatus without

making the design of the host device complicated.

In the host device in accordance with another aspect of the present invention, the time which has the predetermined relation is the time when the host device transmits a command next to the block size setting command to the electronic apparatus.

In the control method of the host device in accordance with another aspect of the present invention, the time which has the predetermined relation is the time when the host device transmits a command next to the block size setting command to the electronic apparatus.

According to these inventions, the host device receives the response to a command next to the block size setting command, and can check the error information about the setting of the block size. As a result, the host device can receive the error information from the electronic apparatus without making the design of the host device complicated.

Effects of the Invention

The present invention can realize the electronic apparatus, the control method thereof, the corresponding host device and the control method thereof wherein when the host device transmits the block size setting data according to a protocol such that a command, a response and data are

transmitted in this order between the host device and the electronic apparatus (for example, IC card) and the electronic apparatus cannot accept the block size setting data, it transmits error information to the host device.

The present invention can realize the electronic apparatus which transmits the error information about the setting of the block size to the host device at predetermined timing regardless of types of the block size setting commands, the control method thereof, the corresponding host device and the control method thereof.

The present invention can realize the electronic apparatus which transmits the error information to the host device without limiting the types of the block size setting command to one type and without making the design of the host device, the control method thereof, the corresponding host device and the control method thereof.

The present invention can realize the electronic apparatus, the control method thereof, the corresponding host device and the control method thereof, wherein overflow of the data buffer for transmission/reception of the IC card is prevented in advance.

The present invention can realize the electronic apparatus, the control method thereof, the host device and the control method thereof, wherein the general-purpose host device and the general-purpose electronic apparatus

can be combined with compatibility.

While the novel features of the invention are set forth particularly in the appended claims, the invention, both as to organization and content, will be better understood and appreciated, along with other objects and features thereof, from the following detailed description taken in conjunction with the drawings.

Brief Description of Drawings

Fig. 1 is a block diagram showing a configuration of an IC card according to a first embodiment of the present invention;

Fig. 2 is a diagram showing transmission of a command, a response and data according to the first embodiment of the present invention;

Fig. 3 is a flowchart showing a first block size setting method according to the first embodiment of the present invention;

Fig. 4 is a flowchart showing a second block size setting method according to the first embodiment of the present invention;

Fig. 5 is a flowchart showing a multi-block transmitting method according to the first embodiment of the present invention;

Fig. 6 is a flowchart showing a first block size

setting method according to a second embodiment of the present invention;

Fig. 7 is a flowchart showing a second block size setting method according to the second embodiment of the present invention; and

Fig. 8 is a diagram showing constitutions of responses according to the second embodiment of the present invention.

Description of reference numerals

101 Host device

102 IC card

111 Interface section

112 Error information creating section

113 Data buffer

114 Function module

121 Block size storage section

122 Buffer capacity storage section

123 Comparison section

124 Response creating section

It will be recognized that some or all of the drawings are schematic representations for purposes of illustration and do not necessarily depict the actual relative sizes or locations of the elements shown.

~~Best Mode for Carrying Out the Invention~~DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiments according to the present invention will be described below with reference to the accompanying drawings.

<<First Embodiment>>

With reference to Figs. 1 to 5, an electronic apparatus (in the present invention, an IC card), a control method thereof, a host device and a control method thereof according to a first embodiment of the present invention are described. Fig. 1 is a block diagram showing a configuration of an IC card according to the first embodiment of the present invention.

In the first embodiment, a host device 101 is a PDA (Personal Digital Assistant) having a slot for inserting the IC card 102.

The host device 101 is connected with the IC card 102 through a command/response line 131, one or plural data line(s) 132, and a clock line 133 for transmitting a communication clock from the host device 101 to an interface section 111. The host device 101 and the IC card 102 are connected by the other lines including a power source line for supplying an electric power from the host device 101 to the IC card 102 and a ground line ~~(not shown).~~ (not shown).

The command/response line 131, the data line 132 and the clock line 133 can be used as electromagnetic wave transmission and ultrasonic transmission by means of different frequencies as well as hard wires.

The host device 101 and the IC card 102 communicate with each other according to a master/slave system in which the host device 101 is a master and the IC card 102 is a slave.

The host device 101 has an interface section (not shown) which uses the command/response line 131, the data line 132 and the clock line 133 so as to transmit/receive a command, a response and data to/from the IC card 102.

The IC card 102 has the interface section 111 that transmits/receives a command, a response and data to/from the host device 101, an error information creating section 112 that creates error information about a block size, a data buffer 113 that temporarily stores data, and a function module 114 having a memory function and/or a wireless communication function.

The error information creating section 112 has a block size storage section 121 that stores a block size determined by the host device 101, a buffer capacity storage section 122 that stores a size of the data buffer 113, and a comparison section 123 that compares the block size with the buffer capacity.

The interface section 111 has a response creating section 124 that creates a response and transmits it to the host device 101.

The interface section 111 of the IC card 102 receives a command transmitted from the host device 101 via the command/response line 131, and transmits a response corresponding to the command to the host device 101.

The interface section 111 of the IC card 102 receives data transmitted from the host device 101 via the data line 132, or transmits data in the IC card to the host device 101.

When the host device 101 communicates with the IC card 102 via the command/response line 131 and the data line 132, a clock is sent from the host device 101 to the IC card 102 via the clock line 133.

When multi-block transmission is carried out, the host device 101 determines a block size of one data block so as to write the block size into the block size storage section 121 of the IC card before the host device 101 transmits/receives the data block. The block size storage section 121 is a register into which the host device 101 writes a block size.

The buffer capacity storage section 122 is a register that stores the capacity of the data buffer 113.

The comparison section 123 compares the block size

written into the block size storage section 121 with the buffer capacity written into the buffer capacity storage section 122. The comparison section 123 transmits a compared result to the response creating section 124.

When the compared result shows that the block size written into the block size storage section 121 is larger than the capacity of the data buffer 113 written into the buffer capacity storage section 122, error information is incorporated in the response by the response creating section 124 and then is transmitted to the host device 101.

The IC card 102 temporarily stores the data block transmitted from the host device 101 via the data line 132 into the data buffer 113 and transmits it to the function module 114. The IC card 102 temporarily stores the data block read out from the function module 114 into the data buffer 113 and transmits it to the host device 101.

The data buffer 113 is a register that temporarily stores the data block.

The function module 114 is a function module with, for example, a flash memory and a wireless communication function.

In Fig. 1, the line between the interface section 111 and the block size storage section 121, the line between the interface section 111 and the buffer capacity storage section 122, the line between the block size storage

section 121 and the comparison section 123, the line between the buffer capacity storage section 122 and the comparison section 123, the line between the comparison section 123 and the response creating section 124, the line between the interface section 111 and the data buffer 113, and the line between the data buffer 113 and the function module 114 may be hard wires~~, however,~~. However, more generally each line ~~are~~ is a command ~~routes~~ route of functions composed of operations of software.

Fig. 2 is a diagram showing exchange of a command, a response and data between the host device 101 and the IC card 102 in a time series. When the multi-block transmission is carried out according to the master/slave communication system in which the host device 101 is a master and the IC card 102 is a slave, a command from the host device to the IC card and a response from the IC card to the host device are transmitted alternately. Thereafter, a plurality of data blocks are intermittently transmitted. Fig. 2 illustrates the case that the host device 101 reads data from the IC card 102.

A command 201, a command 204, and block size setting data 203 are transmitted from the host device 101 to the IC card 102. A response 202, a response 205 and a data block 206 are transmitted from the IC card 102 to the host device 101.

In case, however, that the command 201 is a first block size setting command, the block size setting data 203 shown by a broken line ~~are~~ is not transmitted from the host device to the IC card (details are mentioned later). Only in the case that the command 201 is a second block size setting command, are the block size setting data 203 ~~are~~ transmitted from the host device to the IC card.

Fig. 3 and Fig. 4 are flowcharts of two cases that the host device 101 sets block size in the IC card 102 in this embodiment. Two types of commands shown in Figs. 3 and 4 are used when the host device 101 sets the block size. A difference between the case of Fig. 3 and the case of Fig. 4 is that the command includes the block size setting data or not.

The case of Fig. 3 is firstly explained. Fig. 3 shows the case that the block size is set by the first block size setting command including the setting data.

The host device 101 determines the block size of one data block, and transmits the first block size setting command including the block size setting data (step 301, numeral 201 in Fig. 2).

The interface section 111 of the IC card receives the first block size setting command (step 302). The block size storage section 121 of the IC card 102 stores the block size set by the host device 101 (step 303). The IC

card 102 transmits a response to the host device 101 (step 304, numeral 202 in Fig. 2)

The host device 101 receives the response 202 (step 305).

In the case of Fig. 3, since the first block size setting command (numeral 201 in Fig. 2) includes the block size setting data, the block size setting data 203 shown in Fig. 2 ~~are~~ is not transmitted from the host device 101 to the IC card 102.

In the first embodiment, the comparison section 123 outputs a result of determining whether the received block size is not more than the buffer capacity. The interface section 111 of the IC card inputs the determined result of the comparison section 123 at step 304, and may transmit a response (Ack information or error information) to the first block size setting command based on the determined result. In another way, the interface section 111 of the IC card may transmit Ack information as the response without reference to the determined result of the comparison section 123.

The case of Fig. 4 is described. Fig. 4 illustrates the case that the block size is set by a second block size setting command which does not include the block size setting data.

The host device 101 determines a block size of one

data block, and transmits the second block size setting command (step 401, numeral 201 in Fig. 2).

The interface section 111 of the IC card receives the second block size setting command (step 402). The IC card 102 transmits a response to the host device 101 (step 403, numeral 202 in Fig. 2).

The host device 101 receives the response 202 (step 404). The host device 101 transmits the block size setting data via the data line 132 (step 405, numeral 203 in Fig. 2).

The IC card receives the block size setting data 203 (step 406). The block size storage section 121 of the IC card 102 stores the block size set by the host device 101 (step 407).

The host device 101 uses one of the first block size setting command (Fig. 3) and the second block size setting command (Fig. 4) so as to set the block size in the IC card 102, and next, a process in Fig. 5 is executed.

Fig. 5 is a flowchart showing the multi-block transmission between the host device 101 and the IC card 102. The multi-block transmission in Fig. 5 corresponds to the case that the host device 101 reads data from the IC card 102.

The host device 101 transmits a command for executing multi-block transmission (instruction of reading n

(positive integer which establishes a relation: $n \geq 1$)) data blocks) (step 501, numeral 204 in Fig. 2). The IC card 102 receives the command for executing the multi-block transmission (step 502).

The comparison section 123 of the IC card 102 compares the block size stored in the block size storage section 121 with the size of the data buffer 113 stored in the buffer capacity storage section 122 (step 503).

When the size of the data buffer 113 is less than the block size, the response creating section 124 creates a response including the error information. The interface section 111 transmits the response including the error information (step 504, numeral 205 in Fig. 2). In this case, the IC card 102 does not transmit n data blocks 206 to the host device 101.

When the size of the data buffer 113 is not less than the block size, the response creating section 124 creates a response without error information so as to transmit the response to the host device (step 505, numeral 205 in Fig. 2). The IC card transmits the data blocks to the host device (step 508, numeral 206 in Fig. 2).

The host device 101 receives the response (step 506). The host device 101 determines whether the response 205 includes error information (step 507). When the response does not include error information, the host device

receives the data blocks (step 509).

The IC card 102 determines whether all the n data blocks are transmitted (step 510). The IC card 102 repeats the transmission of the data blocks at step 508 until all the n data blocks are transmitted. When the transmission of all the n data blocks is completed, the process is ended.

When the response includes error information at step 507, the host device 101 transmits a command for requesting transmission of a data buffer capacity of the IC card 102 (step 511).

The IC card 102 receives the command for requesting transmission of the data buffer capacity of the IC card (step 512), and transmits the capacity of the data buffer 113 stored in the buffer capacity storage section 122 to the host device 101 (step 513).

The host device 101 receives the data buffer capacity of the IC card (step 514), and determines a new block size which is not more than the data buffer capacity (step 515). The host device 101 transmits a new block size to the IC card according to the method in Fig. 3 (step 516). The sequence returns to step 501, and the multi-block transmission is re-executed.

The block size may be transmitted to the IC card according to the method in Fig. 4 instead of the process in Fig. 3 at step 516.

The IC card 102 of the present invention can be attached to various kinds of the compatible host devices 101. In case that the block size is determined after the host device 101 properly reads the capacity of the data buffer 113 of the IC card, the IC card 102 does not overflow. Some kinds of the host devices 101, however, do not read the capacity of the data buffer of the IC card and set the block size, or they can not properly read the capacity of the data buffer and thus occasionally set a value larger than the data buffer capacity as the block size.

Even in such a case, before the IC card 102 actually transmits/receives a data block, it can inform the host device of error information such that the block size is larger than the capacity of the data buffer. The IC card 102 of the present invention can prevent the data buffer 113 from overflowing in advance.

In both the cases that the block size is determined by using the first block size setting command (Fig. 3) and by the second block size setting command (Fig. 4), the IC card 102 of the present invention transmits the response including error information to the host device 101 at the same timing (step 504 in Fig. 5). Accordingly, the host device can determine whether the response includes the error information about the block size or not only at step

507. The control method of the electronic apparatus of the present invention can facilitate the design of the host device.

In the first embodiment, although the multi-block transmission in case of reading data from the IC card is explained, the present invention can be applied to the multi-block transmission in case of writing data into the IC card 102 by the host device 101.

In this case, when the block size set by the host device is larger than the capacity of the built-in data buffer, the IC card transmits the response including error information to the command for executing the multi-block transmission to the host device. When a data block is transmitted from the host device, the IC card does not accept it.

When the response includes error information corresponding to the command for executing the multi-block transmission, the host device does not transmit the data block to the IC card. The host device inquires about the data buffer capacity of the IC card so as to set a new block size.

<<Second Embodiment>>

With reference to Figs. 6 to 9, the electronic apparatus according to a second embodiment (in the present invention, the IC card), the control method thereof, the

host device and the control method thereof are described. A difference of the second embodiment from the first embodiment is the timing of transmitting error information such that block size is larger than the capacity of the data buffer 113 to the host device. The other points are the same as those in the first embodiment.

The commands which are used for setting a block size by the host device 101, ~~includes~~ include two kinds of ~~the~~ commands ("the first block size setting command" and " the second block size setting command") which are similar to those in the first embodiment.

In the first embodiment, even when the host device 101 determines a block size by either the first block size setting command or the second block size setting command, the IC card 102 transmits the error information about the block size included in the response after the multi-block transmission command. For this reason, the timing of transmitting the error information by the IC card is delayed.

The second embodiment provides the electronic apparatus that transmits error information about a block size immediately, the control method thereof, the host device and the control method thereof. In the electronic apparatus, the control method thereof, the host device and the control method thereof according to the second

embodiment, the timing that the error information is incorporated in the response is varied according to types of the block size setting commands.

Fig. 6 is a flowchart showing a method in which the host device sets a block size in the IC card by using the first block size setting command including block size setting data. In Fig. 6, the same steps as Figs. 3 and 5 are designated by the same reference numerals in Figs. 3 and 5.

The host device 101 transmits the first block size setting command including the block size setting data (step 301, numeral 201 in Fig. 2).

The interface section 111 of the IC card 102 receives the first block size setting command (step 302). The block size storage section 121 of the IC card 102 stores the block size set by the host device 101 (step 303).

The comparison section 123 of the IC card 102 compares the block size stored in the block size storage section 121 with the size of the data buffer 113 stored in the buffer capacity storage section 122 (step 503).

When the size of the data buffer 113 is less than the block size, the response creating section 124 creates a response which includes error information and the interface section 111 transmits the response (step 504, numeral 202 in Fig. 2). When the size of the data buffer 113 is not

less than the block size, the response creating section 124 creates the response without error information, and the interface section 111 transmits it to the host device (step 505, numeral 202 in Fig. 2).

In case of Fig. 6, since the first block size setting command (numeral 201 in Fig. 2) includes the block size setting data, the block size setting data 203 shown in Fig. 2 ~~are~~ is not transmitted from the host device 101 to the IC card 102.

The host device 101 receives the response 202 (step 506). The host device 101 determines whether the response includes error information or not (step 507). When the response does not include error information, the process is ended. When the response includes error information, the host device 101 transmits the command for requesting transmission of the data buffer capacity of the IC card 102 (step 511).

When the IC card 102 receives the command for requesting transmission of the data buffer capacity of the IC card (step 512), it transmits the capacity of the data buffer 113 stored in the buffer capacity storage section 122 to the host device 101 (step 513).

When the host device 101 receives the data buffer capacity of the IC card (step 514), it determines a new block size which is not more than the data buffer capacity

(step 515). The sequence returns to step 301, and the host device 101 transmits the new block size to the IC card so as to set the block size.

With reference to Figs. 7 and 8, the case of using the second block size setting command is described. Fig. 7 is a flowchart showing a method in which the host device sets a block size in the IC card by using the second block size setting command which does not include block size setting data. In Fig. 7, the same steps as Figs. 4 and 5 are designated by the same reference numerals in Figs. 4 and 5.

Fig. 8 is a diagram showing ~~configration~~ a configuration of a response to be transmitted by the IC card 102 to the host device 101. Fig. 8A shows the normal response which includes a response 801 to the current command transmitted from the host device 101.

Fig. 8B shows the response to a next command transmitted from the host device after the second block size setting command in the second embodiment. The response to the next command in Fig. 8B includes both the response 801 to the current command (transmitted after the second block size setting command) and a response 802 to the previous command (which is the second block size setting command). The response 802 to the previous command includes Ack information or error information about the setting of the block size.

In Fig.7, the host device 101 transmits the second block size setting command (step 401, numeral 201 in Fig. 2).

The interface section 111 of the IC card receives the second block size setting command (step 402). The IC card 102 transmits the response to the host device 101 (step 403, numeral 202 in Fig. 2).

The host device 101 receives the response 202 (step 404). The host device 101 transmits the block size setting data via the data line 132 (step 405, 203 in Fig. 2).

The IC card receives the block size setting data 203 (step 406). The block size storage section 121 of the IC card 102 stores the block size set by the host device 101 (step 407).

The comparison section 123 of the IC card 102 compares the block size stored in the block size storage section 121 with the size of the data buffer 113 stored in the buffer capacity storage section 122 (step 503).

When the size of the data buffer 113 is not less than the block size, the response creating section 124 creates Ack information (step 701). When the size of the data buffer 113 is less than the block size, the response creating section 124 creates error information (step 702).

The host device 101 transmits a next command (step 703). The IC card 102 receives the next command (step 704).

The IC card 102 adds the Ack information or the error information as the response 802 of the previous command to the response 801 to the next command so as to transmit it to the host device (step 705, numeral 205 in Fig. 2).

When the host device 101 receives the response (step 706), it determines whether the response 205 includes error information about the block size (step 707). When the response 205 does not include ~~the~~ error information about the block size (that is, the response includes the Ack information), the host device 101 processes the received response to the next command (step 708).

When the response includes ~~the~~ error information about the block size, the host device 101 transmits the command for requesting transmission of the data buffer capacity of the IC card 102 (step 511).

When the IC card 102 receives the command for requesting transmission of the data buffer capacity of the IC card 102 (step 512), it transmits the capacity of the data buffer 113 stored in the buffer capacity storage section 122 to the host device 101 (step 513).

When the host device 101 receives the data buffer capacity of the IC card (step 514), it determines a new block size which is not more than the data buffer capacity (step 515). The sequence returns to step 401, and the host device 101 transmits the second block size setting command

to the IC card so as to set the block size.

Immediately after the IC card according to the second embodiment of the present invention receives the block size setting data, it can inform the host device of error information about the block size. As a result, even if the block size is set improperly, the IC card can cope with this immediately.

In the first embodiment, the host device 101 and the IC card 102 may use the method of Fig. 6 instead of the method of Fig. 3 to set the block size in the IC card. In this case, when the block size set by the host device 101 is larger than the capacity of the built-in data buffer 113, the IC card transmits error information included in the response to the first block size setting command.

In the second embodiment, the host device 101 and the IC card 102 may use the method in Fig. 3 instead of the method in Fig. 6. When the host device 101 transmits either the first block size setting command or the second block size setting command, the IC card 102 adds Ack information or error information as a response to the previous command (which is the first or second block size setting command) to a response to the next command so as to transmit the response to the host device.

Although the present invention has been described with respect to its preferred embodiments in some detail, the

disclosed contents of the preferred embodiments may change in the details of the structure thereof, and any changes in the combination and sequence of the component may be attained without departing from the scope and spirit of the claimed invention.

Industrial Applicability

The present invention is useful as the electronic apparatus that executes the multi-block transmission with the host device, the control method thereof, the host device and the control method thereof.

ABSTRACT

An electronic apparatus that transmits error information about setting of a block size to a host device ~~without making a design of the host device complicated and a control method thereof, are provided. The electronic apparatus of the present invention has:~~includes an interface section that ~~transmits/receives~~transmits and receives a command, a response and data ~~to/from~~to and from the host device. When~~ and when~~ the data is a predetermined length or more, the interface section executes multi-block transmission~~;~~. Moreover, the electronic apparatus includes a data ~~buffer;~~buffer, and a storage section that stores information about a block size~~, wherein when~~. When the interface section receives a block size setting command transmitted from the host device and the block size is larger than a capacity of the data buffer, it transmits a response including error information about incapability of accepting the block size at the time which has a predetermined relation to the block size setting command.